What is claimed is:

1. A method for generating a linear feedback bit sequence, comprising:

optically performing an exclusive-NOR logical operation on a clocking signal, an initiation signal and a feedback signal;

splitting a signal output of said exclusive-NOR logical operation into at least two optical paths, wherein the split signal in at least one of said at least two optical paths is delayed;

optically performing an exclusive-OR logical operation on the split signals in said at least two optical paths; and

feeding back a signal output of said exclusive-OR logical operation as the feedback signal for said exclusive-NOR logical operation.

2. A method for generating an all-optical linear feedback bit sequence, comprising:

combining a first portion of a first clocking signal and an initiating signal in a first optical path;

combining a second portion of said first clocking signal and a feedback signal in a second optical path;

imparting an intensity-dependent phase modulation on at least one of the combined signals in said first and second optical paths;

coupling the combined signals of said first and second optical paths such that the intensities of the combined signals interfere;

splitting the coupled, combined signal of one of said first or second optical paths into at least a third and a fourth optical path;

providing a delay to the split signal in at least one of said at least third and fourth optical paths;

imparting an intensity-dependent phase modulation on each of the split signals in each of the third and the fourth optical paths;

coupling the split signals of said third and fourth optical paths such that the intensities of the split signals interfere; and

feeding back the coupled, split signal of one of said third or fourth optical paths to be combined with the second portion of said first clocking signal in said second optical path.

3. The method of claim 2, wherein the signal of said first or second optical paths that is split and the signal of said third and fourth optical paths that is fed-back are complementary outputs of said optical paths.

4. The method of claim 2, further comprising combining a first portion of a second clocking signal with the split signal in said third optical path and combining a second portion of said second clocking signal with the split signal in said third fourth optical path prior to the imparting of an intensity-dependent phase modulation.

5. The method of claim 4, wherein said second clocking signal improves the extinction ratio of the all-optical linear feedback bit sequence.

6. The method of claim 2, further comprising filtering said initiating signal prior to imparting an intensity-dependent phase modulation on each of the split signals in each of the third and the fourth optical paths.

7. The method of claim 2, further comprising filtering said feedback signal to remove any remaining component of said first clocking signal.

8. The method of claim 2, further comprising providing an optical delay to said feedback signal to control a total path length for generating said all-optical linear feedback bit sequence.

9. An all-optical linear feedback circuit, comprising:

a first optical logic circuit for performing a logical operation on at least a clocking signal, an initiating signal and a feedback signal,

a delay circuit, including at least two optical paths, wherein at least one

of said at least two optical paths of said delay circuit includes an optical delay element and wherein an output of said first optical logic circuit is split and propagates along each of said at least two optical paths of said delay circuit;

a second optical logic circuit for performing a logical operation on at least the outputs of said at least two optical paths of said delay circuit; and

a feedback path for feeding back an output of said second optical logic circuit to said first optical logic circuit for providing said feedback signal.

10. An all-optical linear feedback circuit, comprising:

a first optical logic circuit, including;

a first input for receiving a first clocking signal for determining the data-rate of the all-optical linear feedback circuit;

a second input for receiving a trigger signal;

a third input for receiving a feedback signal;

at least two optical paths, at least one of said at least two optical paths including at least one nonlinear element for imparting an intensity-dependent phase modulation on a combined signal propagating therein, wherein a first portion of said first clocking signal and said trigger signal are combined and propagate along a first one of said at least two optical paths, and a second portion of said first clocking signal and said feedback signal are combined and propagate along a second one of said at least two optical paths; and

an output coupler for providing a Boolean logic output of an interference between the signals propagating in said at least two optical paths;

a delay circuit, including at least two optical paths, wherein at least one of said at least two optical paths of said delay circuit includes an optical delay element and wherein an output of said first optical logic circuit is split and propagates along each of said at least two optical paths of said delay circuit;

a second optical logic circuit, including;

a first input for receiving a signal from a first optical path of said at least two optical paths of said delay circuit;

a second input for receiving a delayed signal from a second optical paths of said at least two optical paths of said delay circuit, said second optical paths including the delay element;

at least two optical paths, each of said optical paths of said second optical logic circuit including at least one nonlinear element for imparting an intensity-dependent phase modulation on a combined signal propagating therein, wherein a signal from said first input propagates along a first one of said at least two optical paths of said second logic circuit, and a signal from said third input propagates along a second one of said at least two optical paths of said second logic circuit; and

an output coupler for providing a Boolean logic output of an interference between the signals propagating in said at least two optical paths of said second logic circuit,

and

a feedback path feeding back an output of said second optical logic circuit to said first optical logic circuit for providing said feedback signal.

11. The all-optical linear feedback circuit of claim 10, wherein at least one of said nonlinear elements comprises a semiconductor optical amplifier.

12. The all-optical linear feedback circuit of claim 10, wherein the output coupler of said first optical logic circuit provides an exclusive-NOR Boolean logic output of the combined signals of said at least two optical paths of said first optical logic circuit.

13. The all-optical linear feedback circuit of claim 10, wherein the output coupler of said second optical logic circuit provides an exclusive-OR Boolean logic output of the combined signals of said at least two optical paths of said second optical logic circuit.

14. The all-optical linear feedback circuit of claim 10, wherein the trigger signal initiates the operation of the linear feedback circuit.

15. The all-optical linear feedback circuit of claim 10, wherein at least one of said first optical logic circuit and said second optical logic circuit comprises a Mach-Zehnder Interferometer including at least two arms and an output coupler, wherein each arm includes at least one nonlinear element for imparting an intensity-dependent phase modulation on a combined signal propagating therein.

16. The all-optical linear feedback circuit of claim 10, wherein said optical delay element is implemented for selecting a tap value for said all-optical linear feedback circuit.

17. The all-optical linear feedback circuit of claim 10, wherein said optical delay element comprises an optical phase shifter.

18. The all-optical linear feedback circuit of claim 10, wherein said optical delay element comprises a variable optical delay element.

19. The all-optical linear feedback circuit of claim 10, further comprising a second optical delay element for controlling a total optical path length of said all-optical linear feedback circuit.

20. The all-optical linear feedback circuit of claim 10, further comprising a first optical filter for filtering said trigger signal from an output of said first optical logic circuit.

21. The all-optical linear feedback circuit of claim 10, further comprising a second optical filter for filtering any remaining component of said first clocking signal from an output of said second optical logic circuit.

22. The all-optical linear feedback circuit of claim 10, wherein an output of said all-optical linear feedback circuit provides a 2^N-1 bit maximal length pseudo-random bit sequence.

23. The all-optical linear feedback circuit of claim 10, wherein the output coupler of said first optical logic circuit provides an AND Boolean logic output of the combined signals of said at least two optical paths of said first optical logic circuit.

24. The all-optical linear feedback circuit of claim 10, wherein said second optical logic circuit further comprises a third input for receiving a second clocking signal to be combined with the signal from said first input in said first one of said at least two optical paths of said second logic circuit, and the signal from said third input in said second one of said at least two optical paths of said second logic circuit.

25. An all-optical linear feedback circuit, comprising:

a first optical logic means for performing an exclusive-NOR logical operation on at least a clocking signal, an initiating signal and a feedback signal;

a delay circuit, including at least two optical paths, wherein at least one of said at least two optical paths of said delay circuit includes an optical delay means and wherein an output of said first optical logic means is split and propagates along each of said at least two optical paths of said delay circuit;

a second optical logic means for performing a logical operation on at least the outputs of said at least two optical paths of said delay circuit; and

a feedback means for feeding back an output of said second optical logic means to said first optical logic means for providing said feedback signal.